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Food and Feed From White Potatoes

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In times of surpluses of potatoes it is hard to realize that the acreage in potatoes is probably less now than it was in 1882. The surpluses arise because efficiency of production has gone up and the average person's consumption of potatoes has gone down.

From 1943 through 1950, the surplus was never less than 3.5 million bushels in any year. In 1946 it was more than 108 million bushels. Those surpluses were extensively utilized to produce industrial alcohol, starch, and livestock feed; millions of bushels were exported. But in normal times all those uses would not be profitable. Molasses is usually too cheap for potatoes to compete with it as a source of alcohol. Extensive research is going on therefore to increase food consumption and to develop efficient and profitable ways to use surplus and cull potatoes.

Why are we eating fewer potatoes than formerly? Perhaps it is because the population is becoming more urban. A farmer rising before sunup to do heavy work requires a hearty breakfast that may include fried potatoes. The city dweller may do with fruit juice, toast, and coffee. Then, too, our diets are more varied today because quick-frozen and canned perishable foods are more common than a decade ago. Partly to blame, perhaps, is the mistaken belief that potatoes are unduly fattening.

Research in the Department includes studies of ways to raise consumption by improving the quality and widening the variety of foods made from potatoes.

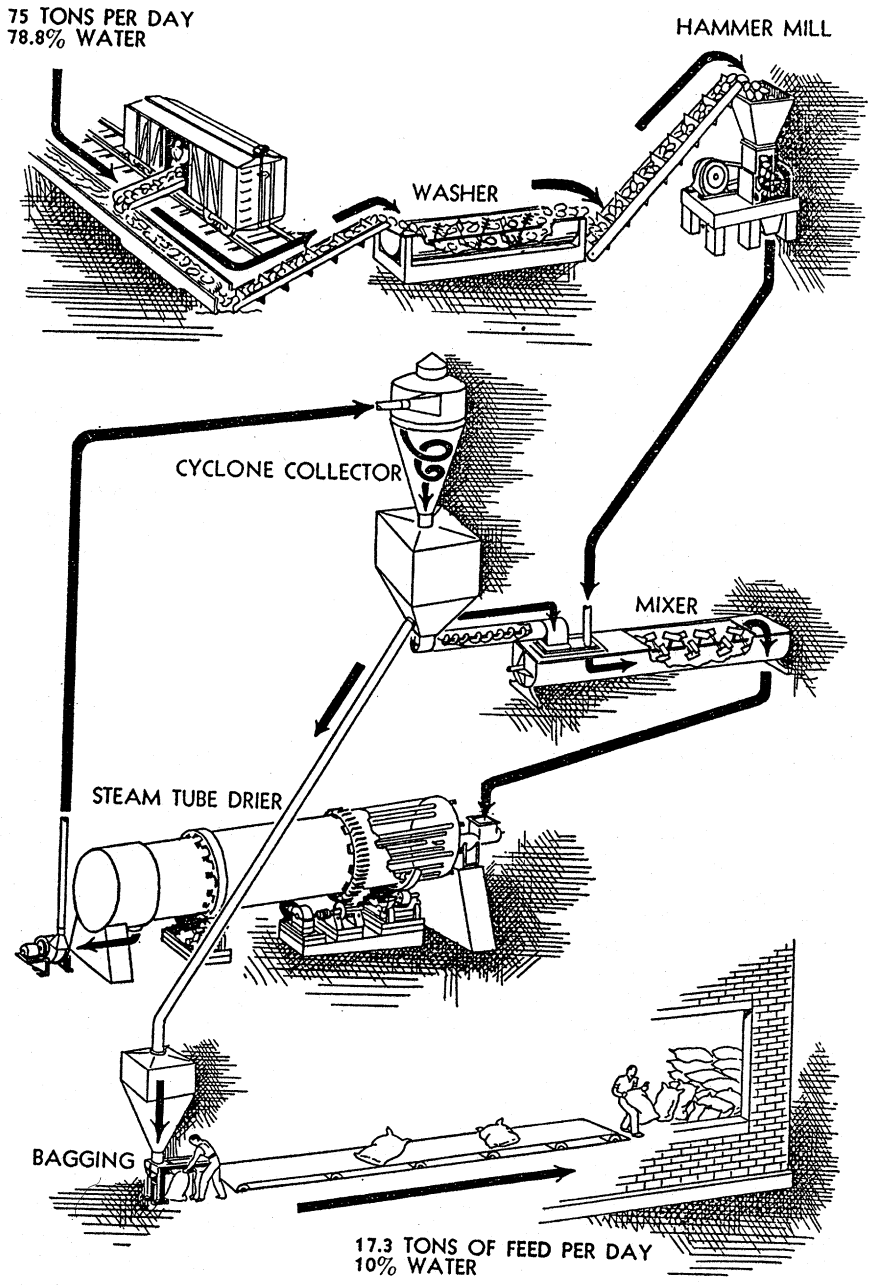
Prepeeled potatoes, needing only to be cooked, are becoming increasingly available to restaurants and housewives. Potatoes may soon be marketed according to their adaptability to different uses. A high-starch potato will bake well but will be too soft for salad; the best type for frying may not be best for mashing.

The problem of nonfood uses is not simple. Potatoes are bulky and perishable. They may rot in storage or lose some of their starch. They contain about 80 percent water, and are costly to ship or to dry.

Raw potatoes contain about 12 percent starch, which is the most valuable constituent as a source of industrial chemicals. Research is being done at the Eastern Regional Research Laboratory to determine how they may be used for lactic acid. Potatoes also contain proteins, minerals, and vitamin C, which are valuable in food or feed. The first thing to be done was to find a cheap way of drying potatoes to preserve them and to reduce their bulk so that they could be shipped economically and used industrially throughout the year.

The dehydration of potatoes for food was studied widely during the war and successful techniques were developed, but until recently little had been done in this country to find cheap drying methods for feed or industrial

FEED FROM DRIED WHITE POTATOES



use. In certain European countries, notably Germany where the agricultural economy was based on potatoes, a great deal had been done on this aspect. A survey was made of European techniques for processing potatoes. New methods of cheap drying were developed at the Eastern Laboratory.

ONE OF THE CHEAPEST WAYS to dry potatoes is to wash them, grind them in a hammer mill, and dry them in a steam-tube drier. But ground raw potatoes are soupy; if fed directly into the drier they would bake on the hot steam tubes. That can be avoided by mixing with the raw ground material about an equal weight of dry product to reduce the average moisture to about 43 percent. Such a mixture can be efficiently dried in a steam-tube drier. The product is granular and light brown in color, and contains the carbohydrates, proteins, and minerals originally in the potato. From its analysis it should have a feed value nearly equal to that of corn.

A plant using the process shown on the opposite page would cost about $80,000, would have a capacity of 75 tons of raw potatoes each 24 hours, and would yield slightly more than 17 tons a day of finished product that contains 10 percent of water. The cost of the product would be about $24 a ton, including everything except the cost of the potatoes and the cost of selling the product.

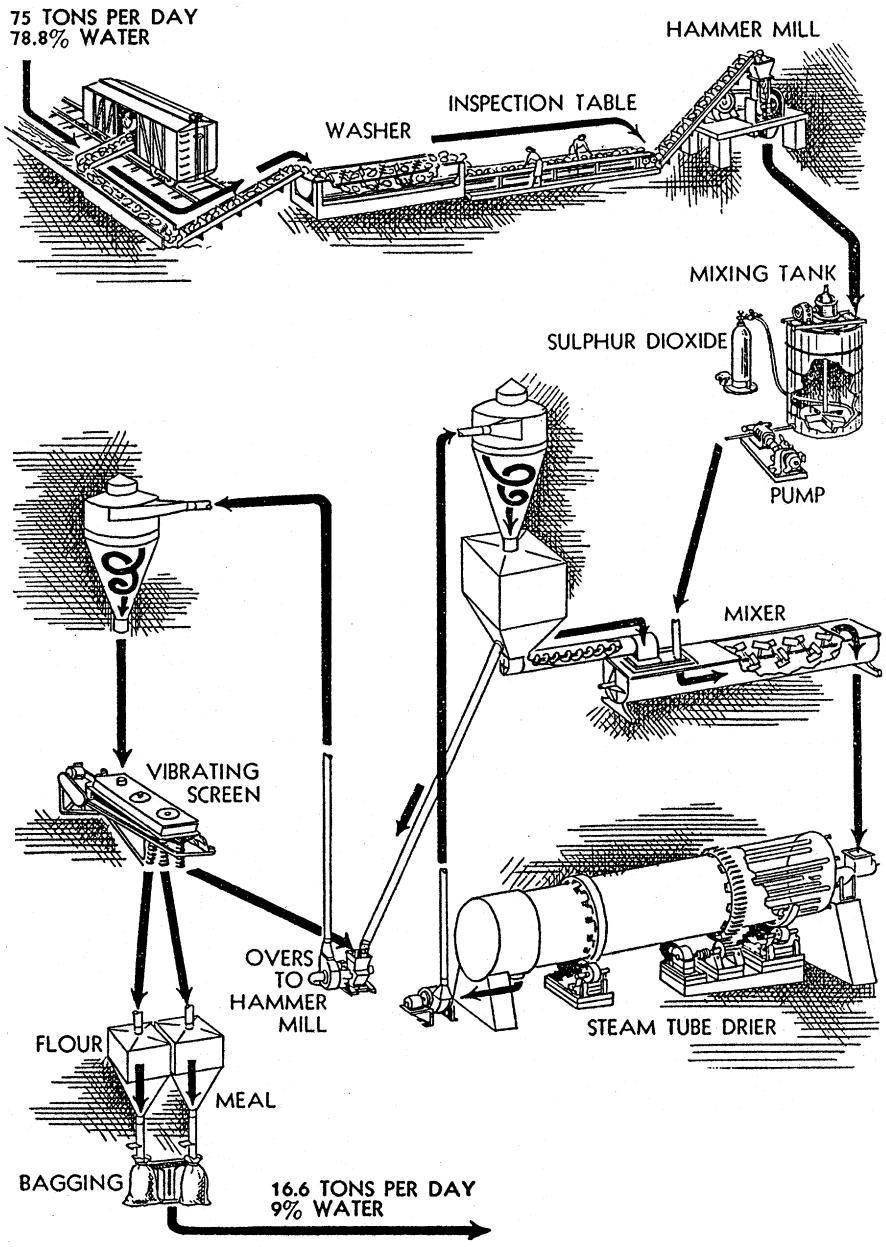
It is possible to add a small amount of lime to the ground potatoes and press out nearly half of the water, thereby saving on the drying costs, but because up to 20 percent of the potato solids may be lost in the press waters, it is questionable that any real over-all economy is achieved. Furthermore, disposing of the expressed juices may prove a serious problem in some places.

Ground raw potatoes may also be dried in high-temperature rotary driers that use gas, oil, or coal as a source of heat. Here again some of the dried product must be mixed with the raw ground material to prevent sticking. In this type of drier, care must be taken to prevent a spark from coming in contact with the finely divided material suspended in air near the outlet of the drier and in the dust collectors, because explosive mixtures of starch and air can form. A means of reducing the explosion hazard is to recycle only that portion of the dried material that will not pass through a 100-mesh screen.

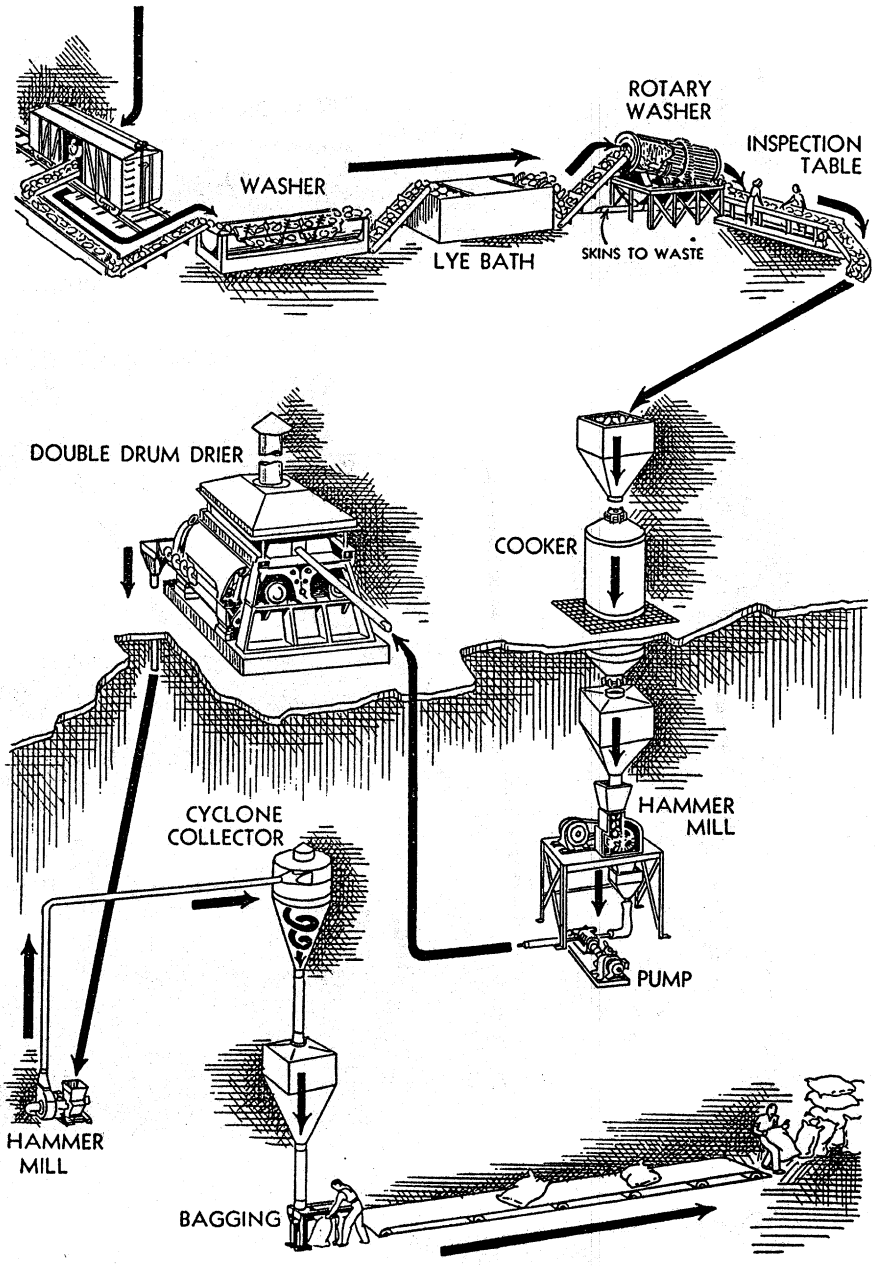
BECAUSE OF THE FOOD SHORTAGE in Europe in 1948 and the need for transporting food in compact form, there arose a demand for approximately 450 million pounds of potato flour—some 10 times the normal United States output. To meet the demand, to utilize surplus potatoes, and to put idle equipment to work, two processes for producing potato flour were developed at the Eastern Laboratory.

One was a simple modification of the steam-tube-drier process developed for producing feed. It was only necessary to add less than 0.1 percent of sulfur dioxide, based on the weight of raw potatoes, to the ground potatoes to maintain their color, and then, after drying as already described, to grind and screen the product to a proper fineness for flour. Much of the equipment necessary for making flour by this method was available in the dry houses of idle distilleries. Even if idle equipment were not available, the entire process could be set up for about $87,000 and operated to produce a potato flour at about $39 a ton. This includes all costs except that of the potatoes and selling costs on the product. It assumes a capacity of 75 tons of potatoes a day. The process is shown in the drawing on page 180.

The second process also utilizes idle distillery dry-house equipment. It is a modification of the conventional process of using specially designed drum driers to dry mashed potatoes, which have been cooked whole. But since the drum driers in distilleries are of a different design, it was found necessary to "cream" the cooked potatoes by hammer milling them while hot and then

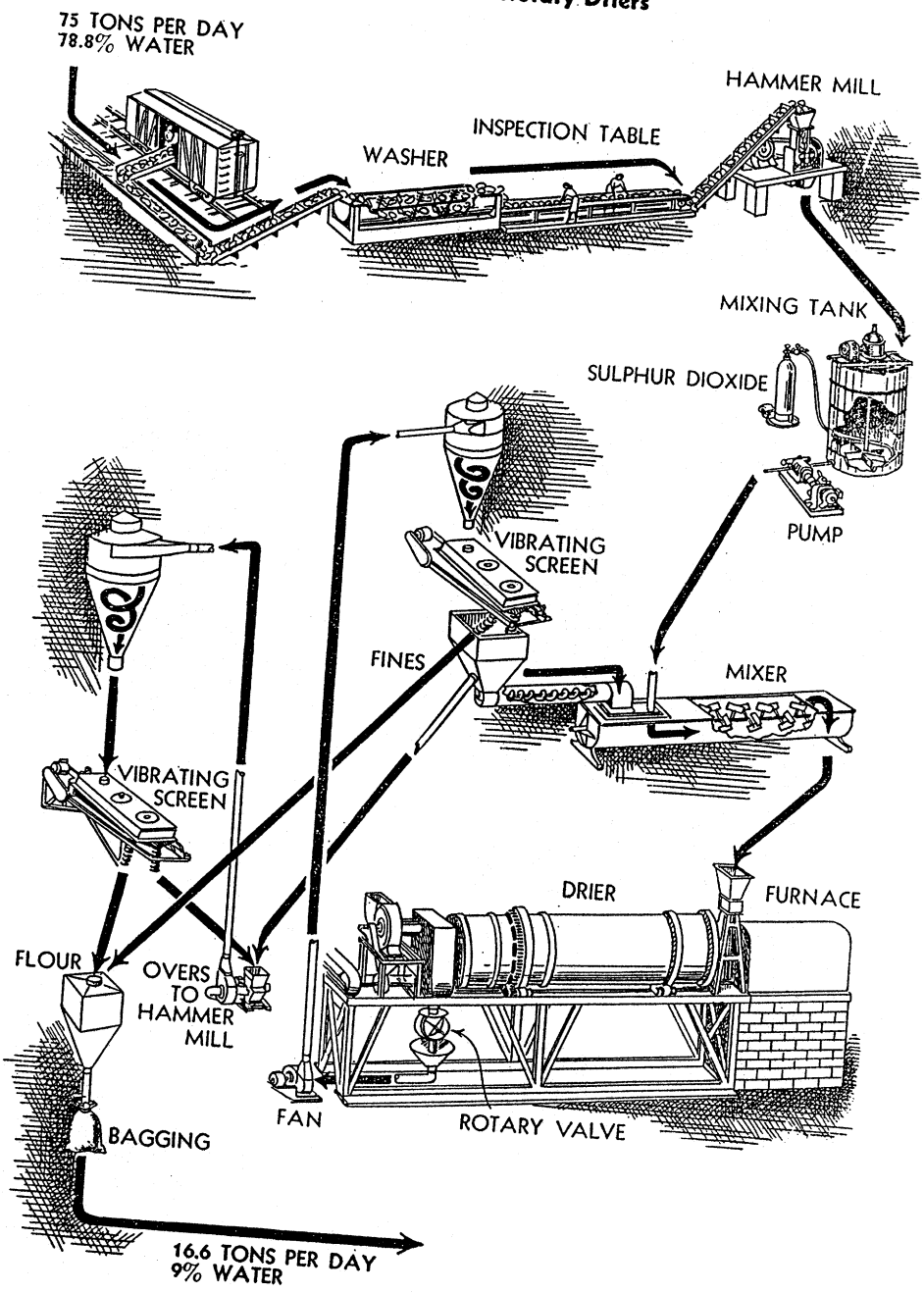

75 TONS PER DAY
78.8% WATER
HAMMER MILL
INSPECTION TABLE
WASHER
MIXING TANK
SULPHUR DIOXIDE
PUMP
MIXER
VIBRATING
SCREEN
OVERS
TO
HAMMER
MILL
STEAM TUBE DRIER
FLOUR
MEAL
BAGGING
16.6 TONS PER DAY
9% WATER

FLOW SHEET FOR POTATO FLOUR MANUFACTURE



FLOUR FROM GROUND WHITE POTATOES

Single Pass Rotary Driers



feed them to the driers at a temperature above 150° F. This process is shown on page 181.

A third method of producing potato flour cheaply comprises grinding the washed potatoes in a hammer mill, treating them with sulfur dioxide, and drying them in a direct-heat, high-temperature rotary drier. The dried product is passed over a 100-mesh screen. The part that passes through the screen is used as flour. A portion of that remaining on the screen is recycled and mixed with the freshly ground potatoes to reduce their moisture content to about 43 percent so that they will not stick in the drier. The excess overs from the screen are ground for flour. The elimination of fines by screening before recycling greatly reduces the explosion hazard. The fourth figure shows this process diagrammatically—page 182.

Between July 1948 and the middle of 1949, 348 million pounds of potato flour was exported to Germany. It is impossible to say how much of this was made by the processes developed at the Eastern Laboratory. However, it is known that two of the methods mentioned were in commercial operation during the period and that the flour was exported. It is understood that much of the flour produced during the period in question was flown into Berlin in the air lift.

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